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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/805,027	03/12/2001	Lloyd G. Burrell	FIS920000242US1	1563

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EXAMINER	
LEWIS, MONICA	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 09/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/805,027	BURRELL ET AL.	
	Examiner	Art Unit	
	Monica Lewis	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 June 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-7,9 and 10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-7,9 and 10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the request for continued examination filed June 21, 2004.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/21/04 has been entered.

Response to Arguments

3. Applicant's arguments with respect to claims 1-3, 5, 7, 9 and 10 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1-3, 5-7, 9 and 10 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The following is not disclosed in the specification: a) "a first layer being of a material which is conductive and having a reactivity with copper substantially equal to or less

than tantalum or tantalum nitride or titanium nitride" (See Claim 1). Claims 2, 3, 5-7, 9 and 10 depend directly or indirectly from a rejected claim and are, therefore, also rejected under 35 U.S.C. 112, first paragraph for the reasons set above.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 3 and 7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Although claim 1 recites a "multi-layer" liner, it only recites a first and a second layer whereas claim 3 recites three layers. Claim 1 should recite a multi-layer liner "comprising at least" the first and second layers. Amending claim 1 in this way would make the claim open to additional layers. Claim 7 depends directly or indirectly from a rejected claim and are, therefore, also rejected under 35 U.S.C. 112, second paragraph for the reasons set above.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1-3 and 5-7 are rejected under 35 U.S.C. 103(a) as obvious over Colgan et al. (U.S. Patent No. 5,565,707) in view of Shue et al. (U.S. Patent No. 6,531,389) and Uzoh (U.S. Patent No. 5,930,669).

In regards to claim 1, Colgan et al. ("Colgan") discloses the following:

a) a patterned aluminum layer (30) (For Example: See Figure 1);

b) a patterned copper layer (40) (For Example: See Figure 1); and

c) an opening (36) in a layer of material, said opening extending between a location on said patterned copper layer and a location on said patterned aluminum layer (For Example: See Figure 1); and

d) stud connection being formed of tungsten (For Example: See Column 1 Lines 15-20 and Column 2 Lines 65 and 66).

In regards to claim 1, Colgan fails to disclose the following:

a) a multi-layer liner where the first layer being of a material such as tantalum or tantalum nitride or titanium nitride and a second layer being of a material that assists in the formation of a stud during deposition of tungsten, one or both first and second layers forming a conductive barrier to process materials are reactive to copper.

However, Uzoh discloses a liner that can be comprised of multiple layers of materials such as tantalum, tantalum nitride, titanium nitride and tungsten (For Example: See Column 4 Lines 20-35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a liner comprising layer of tantalum, tantalum nitride, titanium nitride and tungsten as disclosed in Uzoh because it aids in providing superior electromigration (For Example: See Column 2 Lines 40-55).

Additionally, since Colgan and Uzoh are both from the same field of endeavor, the purpose disclosed by Uzoh would have been recognized in the pertinent art of Colgan.

b) a liner in said opening and having a thickness extending between said stud connection and said location on said copper layer at said location on said patterned copper layer.

However, Shue et al. ("Shue") discloses a liner having a thickness extending between said stud (30a) and copper layer (12) (For Example: See Figure 6). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a liner having a thickness extending between said stud and copper layer as disclosed in Shue because it aids in reducing parasitic capacitance (For Example: See Column 1 Lines 15-67 and Column 2 Lines 1-49).

Additionally, since Colgan and Shue are both from the same field of endeavor, the purpose disclosed by Shue would have been recognized in the pertinent art of Colgan.

Finally, the following limitation makes it a product by process claim: a) "assists in the formation of a stud during deposition;" and b) "forming a conductive barrier to process material which are reactive to copper." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in

"product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 2, Colgan fails to disclose the following:

a) a layer of tantalum nitride, and a layer of PVD tungsten.

However, Uzoh discloses a liner comprising a layer of tantalum nitride, and a layer of tungsten (For Example: See Column 4 Lines 20-35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a liner comprising layer of tantalum nitride, and a layer of tungsten as disclosed in Uzoh because it aids in providing superior electromigration (For Example: See Column 2 Lines 40-55).

Additionally, since Colgan and Uzoh are both from the same field of endeavor, the purpose disclosed by Uzoh would have been recognized in the pertinent art of Colgan.

Finally, the following limitation makes it a product by process claim: a) "PVD tungsten." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA

1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 3, Colgan fails to disclose the following:

a) a layer of tantalum nitride, a layer of titanium nitride and PVD tungsten.

However, Uzoh discloses a liner comprising a layer of tantalum nitride, a layer of titanium nitride and tungsten (For Example: See Column 4 Lines 20-35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a liner comprising a layer of tantalum nitride, a layer of titanium nitride and tungsten as disclosed in Uzoh because it aids in providing superior electromigration (For Example: See Column 2 Lines 40-55).

Additionally, since Colgan and Uzoh are both from the same field of endeavor, the purpose disclosed by Uzoh would have been recognized in the pertinent art of Colgan.

Finally, the following limitation makes it a product by process claim: a) "PVD tungsten." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 5, Colgan discloses the following:

a) a patterned aluminum layer includes a layer of at least one of titanium, and titanium nitride (For Example: See Column 5 Lines 23-27).

In regards to claim 6, Colgan discloses the following:

a) a patterned aluminum layer includes a layer of at least one of titanium, and titanium nitride (For Example: See Column 5 Lines 23-27).

In regards to claim 7, Colgan discloses the following:

a) a patterned aluminum layer includes a layer of at least one of titanium, and titanium nitride (For Example: See Column 5 Lines 23-27).

10. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as obvious over Colgan et al. (U.S. Patent No. 5,565,707) in view of Shue et al. (U.S. Patent No. 6,531,389), Uzoh (U.S. Patent No. 5,930,669) and Jain (U.S. Patent No. 5,933,758).

In regards to claim 9, Colgan fails to disclose the following:

a) a covering layer.

However, Jain discloses a covering layer (50) (For Example: See Column 5 Lines 25-28). It would have been obvious to one having ordinary skill in the art at the time the invention was

made to modify the semiconductor device of Colgan to include a covering layer as disclosed in Jain because it aids in increasing component density (For Example: See Figure 5).

Additionally, since Colgan and Jain are both from the same field of endeavor, the purpose disclosed by Jain would have been recognized in the pertinent art of Colgan.

In regards to claim 10, Colgan fails to disclose the following:

a) a covering layer includes a layer of silane based high density plasma oxide.

However, Jain discloses a covering layer (For Example: See Column 5 Lines 25-28). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a covering layer as disclosed in Jain because it aids in increasing component density (For Example: See Figure 5).

Additionally, since Colgan and Jain are both from the same field of endeavor, the purpose disclosed by Jain would have been recognized in the pertinent art of Colgan.

Finally, the following limitation makes it a product by process claim: a) "silane based high density plasma oxide." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA

1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 571-272-1838. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML
September 2, 2004

Mary Wilczewski
Primary Examiner